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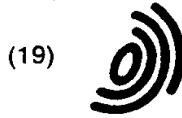
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- Binnert, Thomas R.  
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### (54) Ink container with improved sealing of ink container outlet port

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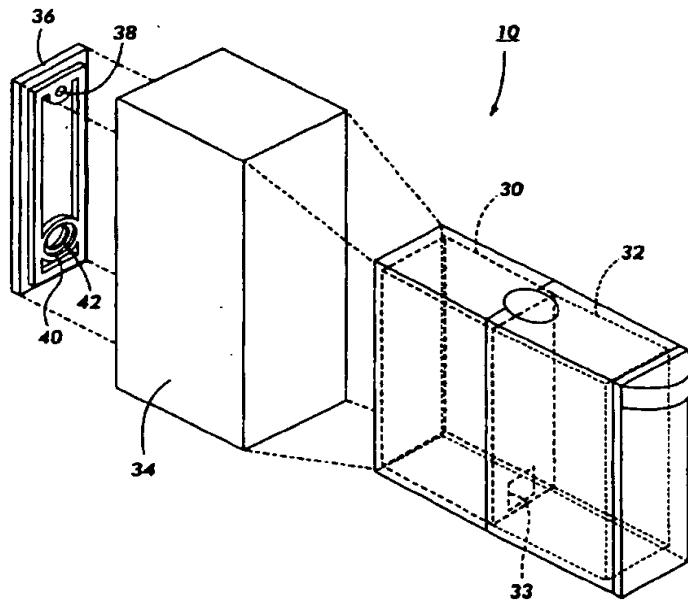


FIG. 2

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## Description

[0001] The present invention relates to ink recording devices and, more particularly, to an improved sealing connection between the outlet port of an ink supply container and a manifold connecting the ink to a printhead.

[0002] Ink jet recording devices include one or more printheads which eject ink onto a print medium such as paper in controlled patterns of closely spaced dots. To form color images, multiple printheads are used, with each printhead being supplied with ink of a different color from an associated ink container.

[0003] Thermal ink jet printing systems use thermal energy selectively produced by resistors located in capillary filled ink channels near channel terminating nozzles or orifices to vaporize momentarily the ink and form bubbles on demand. Each temporary bubble expels an ink droplet and propels it toward a recording medium. The printing system is generally incorporated in a carriage type printer. A carriage type printer generally has a relatively small printhead containing the ink channels and nozzles. The printhead is usually sealingly attached to an ink supply container and the combined printhead and container form a cartridge assembly which is reciprocated to print one swath of information at a time on a stationarily held recording medium, such as paper. After the swath is printed, the paper is stepped a distance equal to the height of the printed swath, so that the next printed swath will be contiguous therewith. The procedure is repeated until the entire page is printed.

[0004] Ink from the ink supply container is drawn by capillary action through an outlet port in the container and into a manifold fluidly connecting ink to the printhead. The manifold supplies ink to the ink channels replenishing the ink after each ink ejection or firing from the associated nozzle.

[0005] The ink container and printhead may be combined in an integral printhead cartridge assembly as is known in the art. With this arrangement, once the ink has been spent, the entire cartridge is replaced. Since the printhead is still useable, this is an inefficient design for many applications. An alternate arrangement is to connect an ink outlet port of a detachable ink container to a printhead via an ink manifold which includes an ink pipe which is seated within an outlet port. The pipe fluidly connects the ink, typically held in a porous material, to the printhead.

[0006] One problem associated with the detached ink container design is ink leakage around the seated manifold ink pipe back into the manifold and printhead housing. The leakage occurs when the pipe touches or compresses the very saturated foam but before the cover is seated to the silicone seal. Various methods are known to provide ink sealing. U.S. Patent 5,519,425 discloses a thin polyester film having an aperture therethrough which is bonded to the ink container and to the printhead. U.S. Patent 5,488,401 shows an outer opening of an ink supply port sealed with a sealing member. This

design allows the ink container to be replaced when ink has run out while retaining the still operable printhead.

[0007] There is still a need for an improved sealing arrangement which reduces ink leakage after fluid connection to a printhead.

[0008] The present invention is directed to an ink container which reduces the leakage occurring during and after flow connection of the container to a printhead. The improvement is enabled by forming the ink outlet port of the ink container with a first diameter and, internal to the port, forms a resilient sealing ring having a second, smaller inner diameter. When a manifold ink pipe is introduced into the ink outlet port, a sealing engagement is made at the interface of the sealing ring inner surface and the ink pipe outer surface. This sealing engagement provides a non-hermetic seal which prevents ink from the ink saturated porous material from flowing along the outer surface of the pipe back onto the manifold and printhead housing.

[0009] More particularly, this invention relates to an ink supply container internally seating an ink absorbing member, said container having an ink outlet port; the ink container characterized by said outlet port having a length  $l$  and a diameter  $d_1$ , said outlet port having a sealing ring formed interior thereto at a location along said length  $l$ , said ring having an internal diameter  $d_2$  smaller than said diameter  $d_1$ .

[0010] An embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

[0011] FIG. 1 shows a perspective view of a full color ink jet printer which incorporates the ink supply container of the present invention.

[0012] FIG. 2 is an exploded view of the ink container of FIG. 1 prior to being fluidly connected to a printhead.

[0013] FIG. 3 is a cross-sectional view of the container of FIG. 2.

[0014] FIG. 4 is an end view of the container of FIG. 2.

[0015] FIG. 5 is an exploded view of the manifold connection to the ink container of FIG. 1.

[0016] FIG. 6 is a cross-sectional side view of the ink outlet port of the container of FIGS. 3-5 just prior to installation of a manifold ink pipe.

[0017] FIG. 7 is a cross-sectional side view of the ink outlet port of FIGS. 3-5 sealingly seated in the ink outlet port.

[0018] FIG. 1 illustrates a perspective view of a full color thermal ink jet printer 6 which incorporates an ink container with improved sealing at the outlet port connection to an ink pipe manifold. Printer 6 includes an ink jet cartridge 8 comprising detachable ink containers 10, 12, 14, 16 fluidly connected to a segmented printhead 18. Cartridge 8 is seated on a carriage 19 supported on rails 20. The carriage rails are supported by a frame 22 of the ink jet printer 6. Each ink container comprises a detachable housing containing black or a colored ink for supply to printhead 18 via an ink manifold. The printhead 18 selectively expels droplets of ink under control

of electrical signals received from a controller (not shown) of the printer 8 through an electrical cable (not shown).

[0019] Printhead 18 includes a plurality of ink channels which carry ink from an associated containers 10, 12, 14, 16 to groupings, or segments of respective ink ejecting orifices or nozzles. When printing, the carriage 19 reciprocates back and forth along the carriage rails 20 in the direction of the arrow 21, the entire width traverse constitutes a scanning path. The actual printing zone is contained within the scanning path. As the printhead cartridge 8 reciprocates back and forth along a print path and past a recording medium 34, such as a sheet of paper or a transparency, droplets of ink are expelled from selected ones of the printhead 18 nozzles towards the sheet of paper. Typically, during each pass of the carriage 19 the recording medium 34 is held stationary. At the end of each pass, the recording medium 34 is stepped in the direction of the arrow 36. For a more detailed explanation of the operation of printer 6 and for the details of the printhead construction, reference is hereby made to U.S. Patent No. 4,571,599, 4,833,491, and U.S. Patent No. Reissue 32,572, which are incorporated herein by reference.

[0020] FIG. 2 shows an exploded view of one of the improved ink containers 10 prior to being fluidly connected to the associated printhead. FIG. 3 shows a cross-sectional side view of the container in an ink-loaded condition, and FIG. 4 is an end view of the container. Referring to FIGS. 2-4, container 10 includes a housing consisting of two compartments 30, 32. Compartment 30 has a porous material, in a preferred embodiment, foam member 34, which becomes saturated with ink moving from compartment 32 via internal port 33, compressively stored therein. A cover 36 is sealingly affixed to the open end of the container. Cover 36 has an air vent 38 and an ink outlet port 40 formed therein.

[0021] As shown in FIGS. 3 and 4, port 40 has a length  $l$  (for this embodiment, the width of cover 36) and a diameter  $d_1$ . According to the invention, port 40 has a sealing ring 42 formed interior to the port at a location along length  $l$  and having an internal diameter  $d_2$  smaller than the port diameter  $d_1$ . The function of ring 42 is discussed below. Although ring 42 is shown in FIG. 3 as being located near the ink input end of port 40, ring 42 could be located at other interior positions along length  $l$  even to the point of extending slightly into compartment 30.

[0022] In a preferred embodiment, cover 36 and ring 42 are made of polypropylene, and the ring has a thickness between 0.1 mm and 0.3 mm, with ring 42 slightly angled towards the interior of the ink container; e.g., towards compartment 30. Port 40 has a diameter  $d_1$  of 7.5 mm, and ring 42 has an inner diameter of  $d_2$  of 6.10 mm. Length  $l$  is 2.72 mm, and ring 42 is positioned 2 mm from the port entrance. The ring 42 provides a seal against ink leakage into the printhead cartridge during and following insertion of ink tanks 10, 12, 14, 16. Referring to

FIGS. 5, 6 and 7, FIG. 5 shows an exploded view of ink tanks 10-16 connected to a manifold member 52. Manifold member 52 comprises a plate 54 with ink pipes 56A-56D attached thereto. A sealing member 50 has a plurality of apertures 52A-52D therethrough and is seated on manifold 52 so as to fit snugly over the ink pipes 56A, 56B, 56C, 56D. When the manifold is in an operative position, member 50 is compressed against the exterior surface of cover 36 around the outlet ports of each ink tank 10-16. FIG. 6 shows a cross-sectional view of one of the ink pipes 56A before insertion into port 40 of container 22. It is noted that the diameter  $d_3$  of pipe 56A is larger than the inner diameter  $d_2$  of ring 42. FIG. 7 shows ink pipe 56A seated within port 40 and extending into contact with foam member 34 a distance  $f$  of about 1.76 mm establishing a capillary flow of ink from the member through the ink pipe manifold and into the associated printhead. Ring 42 is compacted and is forced, or extruded, upwards by pipe 56A, establishing a sealing contact along interface C formed along the outer surface, or annulus, of pipe 56A and the inner compressed surface of ring 42.

[0023] While the embodiment disclosed herein is preferred, it will be appreciated from this teaching that various alternative, modifications, variations or improvements therein may be made by those skilled in the art. For example, the ink container may comprise a single compartment in place of the two shown in the drawings.

### Claims

1. An ink supply container (10) internally seating an ink absorbing member (34), said container having an ink outlet port (40); characterized in that the ink outlet port (40) has a length  $l$  and a diameter  $d_1$ , and the said ink outlet port has a sealing ring (42) formed interior thereto at a location along said length  $l$ , said ring (42) having an internal diameter  $d_2$  smaller than said diameter  $d_1$ .
2. A container according to claim 1 wherein the sealing ring (42) is integrally molded as part of the outlet port (40).
3. A container according to claim 1 or 2 wherein the sealing ring (42) is polypropylene with a thickness of between 0.1 mm and 0.3 mm.
4. A print cartridge for an ink jet printer comprising, in combination:
  - at least one ink container (10) having a compartment for holding an ink-impregnated porous member (34), and having an ink outlet port (40),
  - a printhead (18),
  - a manifold for fluidly connecting ink to said

printhead (18), said manifold including an ink pipe (56A) seated in said outlet port (40) and contacting said porous member (34) so as to establish a capillary flow of ink through said manifold to said printhead, said ink pipe (56A) having a diameter  $d_3$ , characterized in that the outlet port (40) has a diameter  $d_1$ , slightly larger than the pipe diameter and a length  $l$ , and the outlet port (40) has a sealing ring member (42) formed along length  $l$  and with a diameter  $d_2$ , smaller than  $d_3$ , said sealing ring member (42) making sealing contact along the circumference of the seated ink pipe (56A). 5

5. A print cartridge according to claim 4 wherein said ink manifold comprises a plurality of ink pipes (56A, 56B, 56C, 56D) which project into a plurality of ink containers (40), the print cartridge being used in a full color printer. 15
6. A print cartridge according to claim 4 or 5 wherein said ring member is polypropylene having a thickness of between 0.1 mm and 0.3 mm. 20

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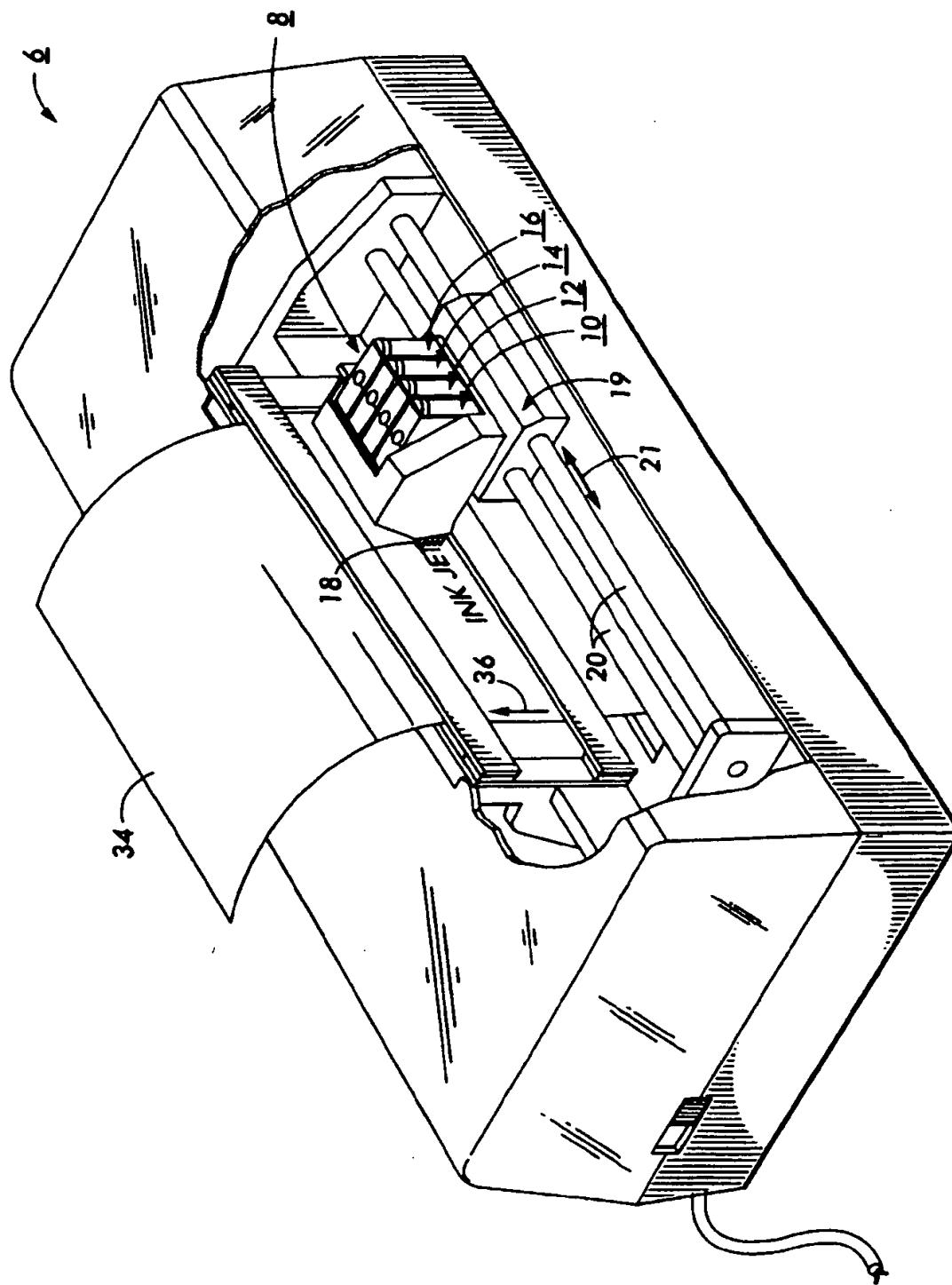
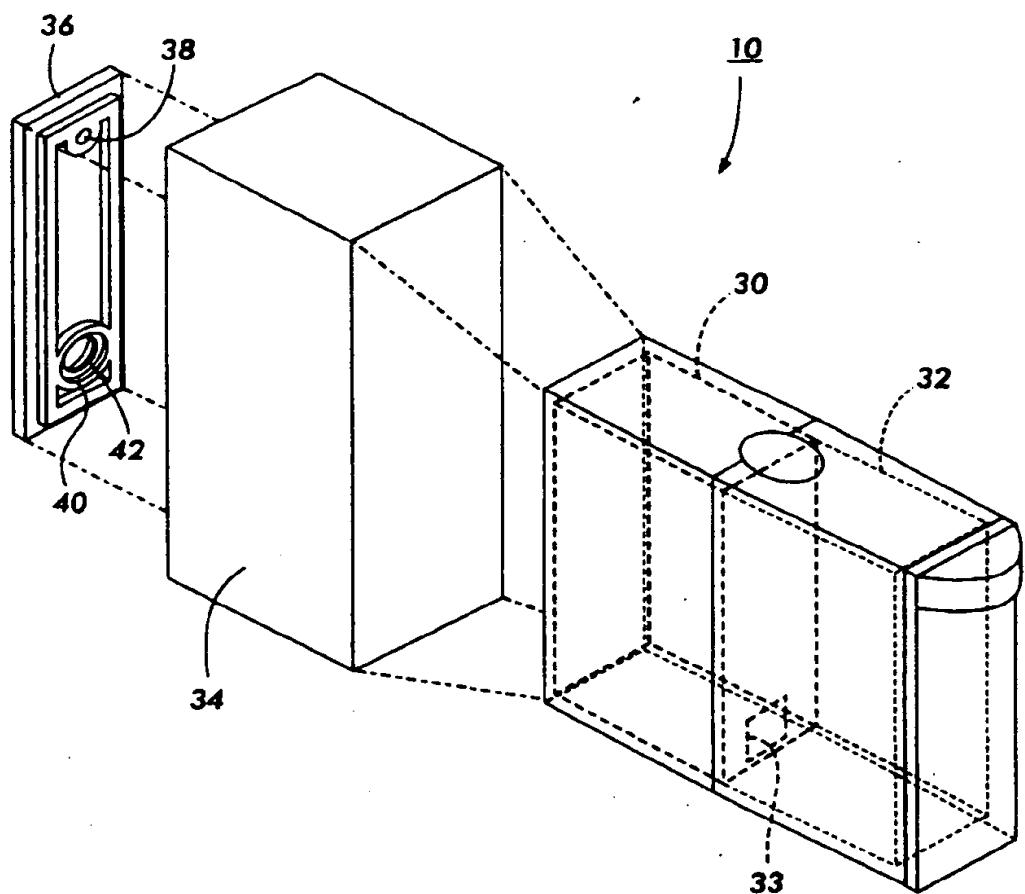
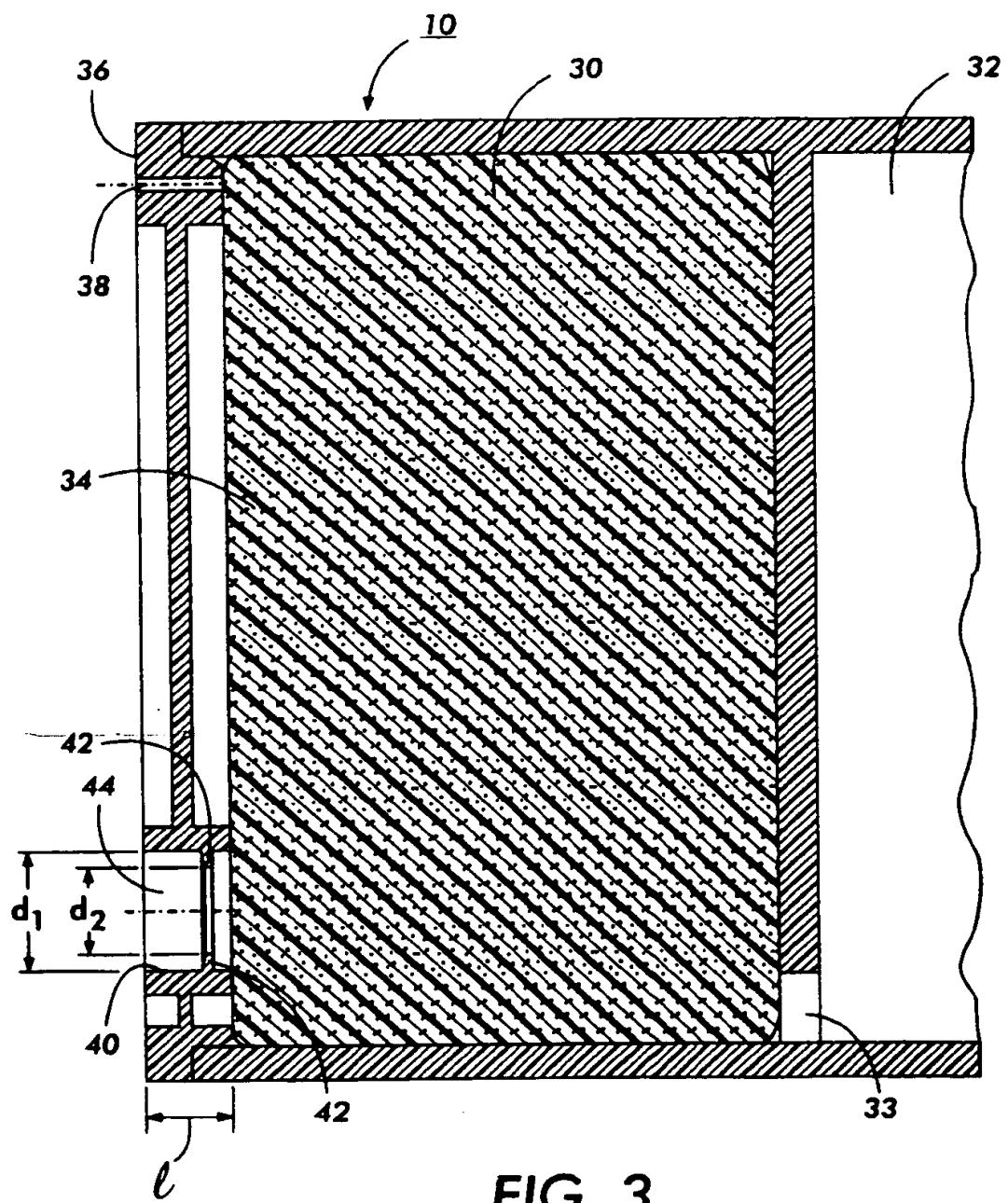


FIG. 1



**FIG. 2**



**FIG. 3**

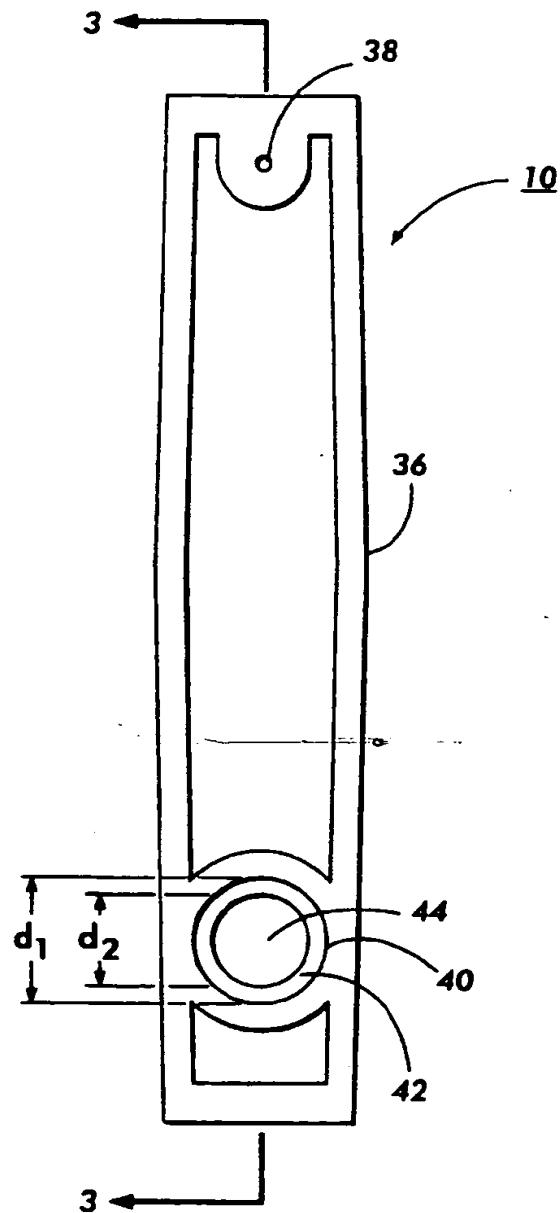
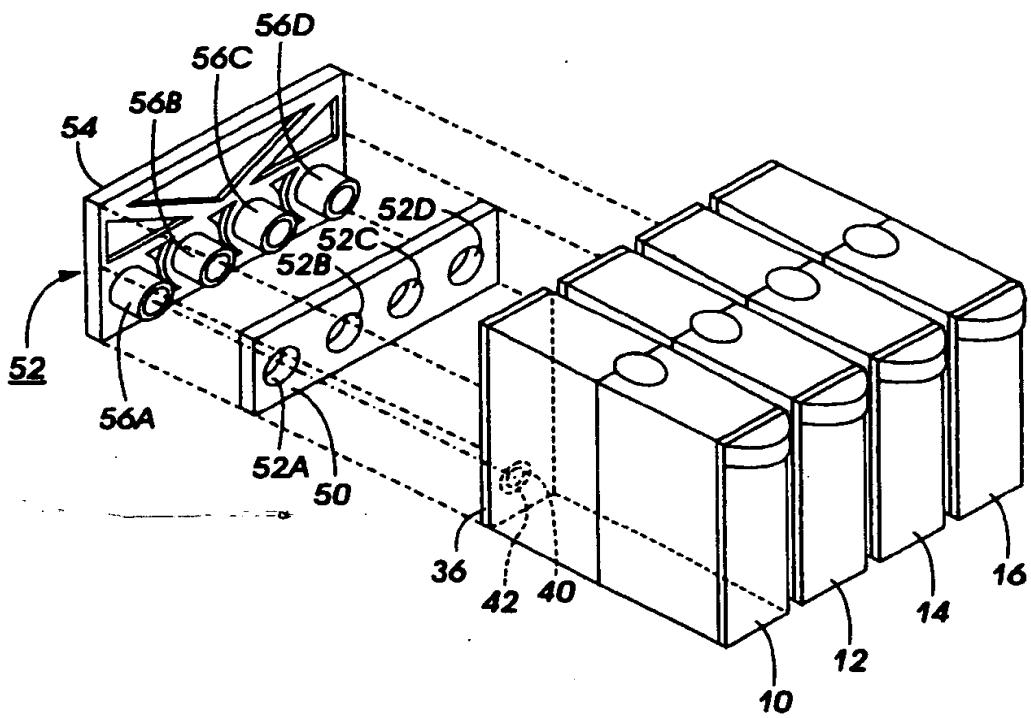
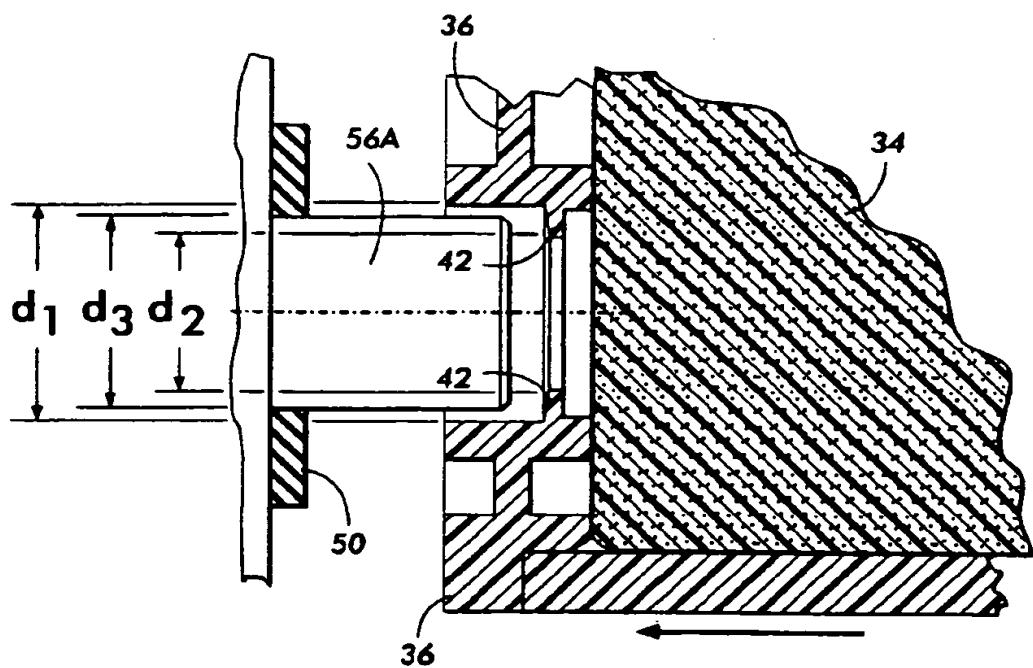


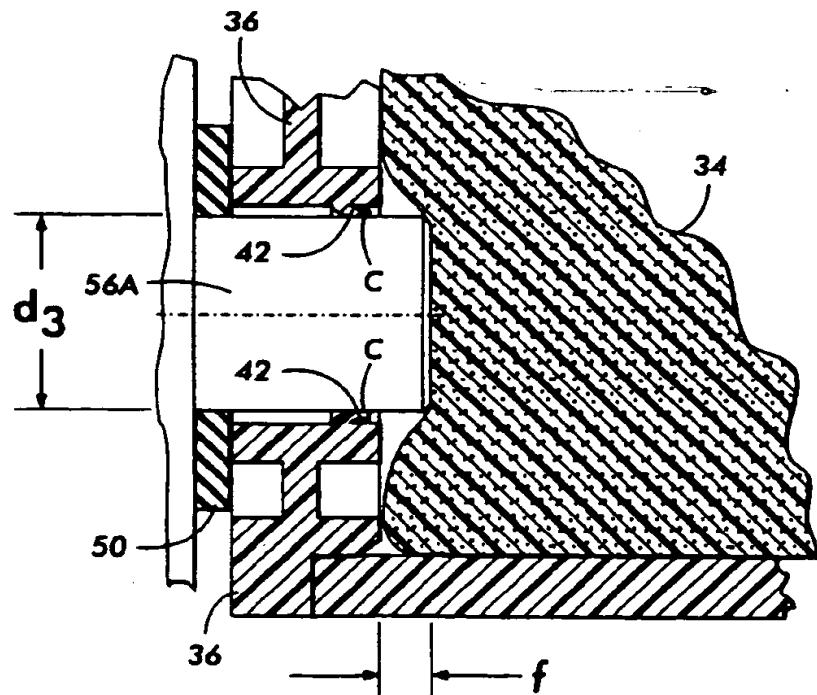
FIG. 4



**FIG. 5**



**FIG. 6**



**FIG. 7**



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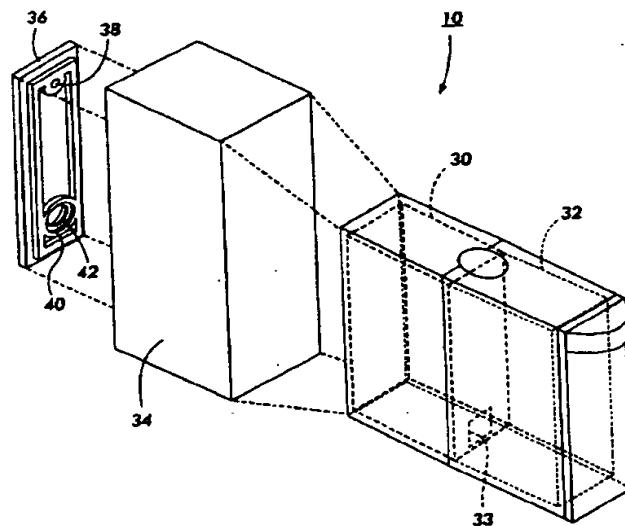


FIG. 2



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## EUROPEAN SEARCH REPORT

Application Number

EP 99 30 1352

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
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A	EP 0 665 108 A (SEIKO EPSON CORPORATION) 2 August 1995 (1995-08-02) * column 3, line 36 - column 7, line 3; figures 1-5 *	1,4	
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The present search report has been drawn up for all claims			
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